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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/941,533	08/29/2001	Ammar Derraa	MTI-31533	4578

31870 7590 02/04/2004

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EXAMINER
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FOURSON III, GEORGE R

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 02/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 09/941,533	Applicant(s) DERRAA, AMMAR	
	Examiner George Fourson	Art Unit 2823	<i>AW</i>

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
  - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
  - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
  - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 10 November 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-73 and 101-129 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-73 and 101-129 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

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Claims 1-3,6-10,35,101,106 and 112 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 35, it appears that - - the - - should precede "heat treatment" unless another step is intended. Applicant argues that the claim has been so amended. However, no such amendment has been made.

In claims 1-3,6-10,101,106 and 109-112, it is unclear what is recited through use of "undesirable" because this is not an inherent property of materials. If applicant intends particular properties or function of the material it should be clearly recited. Applicant argues that the term is defined and/or understood by one of ordinary skill in the art. However, the pointed to definition does not unambiguously define the term. Furthermore, the definition is not sufficient because of the reasons stated above and in the office action mailed 8/8/03. The considerations determining what materials are encompassed are judgments and opinions that are not properties of materials. For example, what is considered as adversely affecting the device to one observer may be considered to be an advantage by another observer. Also, the definition provided is subjective and does not establish the intended properties of the material.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1,2,3-9,11,12,13,14,16,17,18,19,21,22,23,24,26,27,28,30,31,34,35,37,38,40-45,49,68,71,101-105,112,114,116,120 and 121 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in view of Hu et al.

The rejection is maintained as stated in the paper mailed 8/8/03 to be applied to claims 2,12,17,23,27,31,34,35,40-45,114 and 116, the claims as amended now requiring a temperature equal to or greater than 700°C.

One of ordinary skill in the art would have been led to the recited temperature range in view of the disclosed temperature of "about 680°C" with a reasonable expectation of success because the small, 20°C, temperature difference would not have been expected to render the disclosed process inoperable and would be seen as within the range disclosed by "about 680°C".

Applicant argues that the reference teaches away from use of thermal annealing in NH<sub>3</sub> by disclosing a preference for H<sub>2</sub>/N<sub>2</sub> plasma and from use of temperatures above 650°C. This argument is respectfully traversed because, although not taught as a preferred embodiment, Wang et al teaches these embodiments nonetheless, and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 169 USPQ 423 (CCPA 1971). "A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." In re Gurley, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments. Merck & Co. v. Biocraft Laboratories, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989). Even a teaching away from a claimed invention does not render the invention patentable. See Celeritas Technologies Ltd. v. Rockwell International Corp., 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed.

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Cir. 1998), where the court held that the prior art anticipated the claims even though it taught away from the claimed invention. "The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed." To further clarify, a prior art opinion that a claimed invention is not preferred for a particular limited purpose, does not preclude utility of the invention for that or another purpose, or even preferability of the invention for another purpose.

Claim 115 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in combination with Hu et al as applied to claims 1,2,3-9,11,12,13,14,16,17,18, 19,21,22,23,24,26,27,28,30, 31,34,35,37,38, 40-45,49,68,71,101-105,112,114,116,120 and 121 above, and further in view of Leem or Japan 5-267220 (Japan '220).

The combination of Wang et al and Hu et al does not include formation of a boron containing titanium nitride film to form the contact.

Leem discloses formation of a high aspect ratio opening, formation of a combination of titanium nitride and titanium boronitride layers (col.5, lines 47-55) to form a contact.

Japan '220 discloses formation of a titanium boronitride barrier layer (abstract and translation page 8) to form a contact.

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Wang et al with the teachings of either one of Leem or Japan '220 to enable formation of the titanium nitride layer of Wang et al having properties disclosed by Leem or Japan '220 associated with the incorporation of boron in the material.

The additional teachings of Japan '220 pointed to by applicant do not render those relied on invalid.

Claims 10,15,20,25,29,32,39,50,51-59,61,62,63,67,66,69,70,73,106,107,108, 109,72,108,109,110,111,113,117,118,119,122 and 123 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in view of Hu et al as applied to claims 1,2,3-9,11,12,13,14,16,17,18, 19,21,22,23,24, 26,27,28,30, 31,34,35,37,38, 40-45,49,68,71,101-105,112,114,116,120 and 121 above, and further in view of Leem or Japan '220.

Wang et al fails to disclose formation of one or more of the alternating layers as a titanium boronitride layer.

Leem or Japan '220 are applied as discussed above as providing motivation to form one or more of the titanium nitride layers of Wang et al using titanium boronitride.

The additional teachings of Japan '220 pointed to by applicant do not render those relied on invalid.

Claims 36,46,47,48,65 and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in view of Hu et al as applied to claims 1,2,3-9,11,12,13,14,16,17,18, 19,21,22,23,24,26,27,28,30, 31,34,35,37,38, 40-45,49,68,71,101-105,112,114,116,120 and 121 above, and further in view of Doan et al.

Wang et al fails to disclose formation of the  $\text{TiSi}_2$  layer by PECVD or sputtering.

Doan et al discloses formation of a titanium silicide layer by PECVD [0034] or sputtering [0007] to form a contact.

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Wang et al and Doan et al to enable the  $\text{TiSi}_2$  layer of Wang et al to be formed.

To further clarify, the claim requires plasma enhanced CVD, otherwise known as "plasma assisted CVD" as disclosed by Doan at [0034].

The teachings of Wang et al in view of Doan do not include RTA to reduce the chlorine content below 3% by weight

Hu et al discloses multi-step deposition/treatment of a titanium nitride film using  $\text{NH}_3$ ,  $\text{TiCl}_4$  and  $\text{H}_2$  (col.1, line 67) including RTA at about  $680^\circ\text{C}$  (col. 5, line 6) in  $\text{NH}_3$  (col.4, line 66). The chlorine content would be reduced to the recited extent because the same materials would be treated in the same manner as in the instant invention. Alternatively, one of ordinary skill in the art would have been led to the recited duration and/or conditions of the RTA step to achieve a desired reduction in resistivity (col.5, lines 1-5).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Wang et al and Hu et al to enable the thermal treatment step of Wang et al to be performed or to obtain the benefits of reducing the contact resistance of the contact as disclosed by Hu et al.

Claims 60,124,125,126 and 127 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in view of Hu et al as applied to claims 1,2,3-9,11,12,13,14,16,17,18, 19,21,22,23,24,26,27,28,30, 31,34,35,37,38, 40-45,49,68,71,101-105,112,114,116,120 and 121 above, and further in view of applicant's admitted prior art, AAPA.

Wang et al discloses formation of contact to source/drain to have been known prior to applicant's invention [0006].

Applicant admits the process of forming Al interconnects over contacts to have been known prior to applicant's invention (instant pages 1 and 2).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Wang [0006] and AAPA to enable formation of a source/drain contact and/or an interconnect.

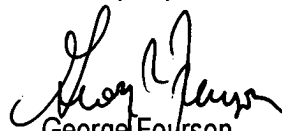
Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group Receptionist whose telephone number is (703) 308-0956. See MPEP 203.08.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner George Fourson whose telephone number is (703) 308-2544. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794. The fax number for this group is (703)308-7722 (or extensions 7724, 3431 or 3432) for regular communications and (703)308-7382 for after final communications.

  
George Fourson  
Primary Examiner  
Art Unit 2823

GFourson  
January 29, 2004